4. MATERIAL AND EQUIPMENT IDENTIFICATION AND DISPOSITION PATHS

Table 1 lists the equipment and structures used in the retrieval demonstration portion of the OU 7-10 Glovebox Excavator Method Project, the expected waste category after use, and the planned final disposition location. This table is a distillation of Appendix A of the Project Waste Management Plan (INEEL 2002c), which is the governing document for disposition of materials from the project. Table 1 shows only the equipment and structures used in the excavation and the handling of this material through final disposition. Other waste materials created during the shutdown, layup and D&D&D phases of the project are covered in the Project Waste Management Plan (INEEL 2002c).

Radiologically contaminated equipment and structures used for the OU 7-10 retrieval demonstration project will be sent to the ICDF for disposal when practical. Although it is assumed that a portion of the materials may not be readily decontaminated to less than 10 nCi/g TRU contamination and will require onsite storage. A small amount of waste may also contain greater than 10 nCi/g of TRU but less than 100 nCi/g. No current disposition path exists for this material; therefore, it will be stored until a disposal path is defined in Stage III.

5. WASTE GENERATION ESTIMATES

Waste generation estimates for the OU 7-10 Glovebox Excavator Method Project from construction through final D&D&D operations are given in the Project Waste Management Plan (INEEL 2002c). Below is a summary of the waste generation estimates for the facility shutdown, layup, and D&D&D phases:

- Onsite storage (TRU and MTRU waste) = 130 yd^3
- Idaho National Engineering and Environmental Laboratory CERCLA Disposal Facility (LLW and MLLW) = 350 yd^3
- Idaho National Engineering and Environmental Laboratory landfill (industrial waste) = 150 yd^3
- Total waste generated during shutdown, layup, and D&D&D phases = 630 yd^3.

6 SCHEDULE

A timeline has been developed and included as Figure 9. This timeline is preliminary only and represents a rough order of magnitude estimate of the durations involved in performing the facility shutdown and D&D&D activities as described in this plan. The timeline has been provided for information only and is not suitable for use in establishing project milestones or for cost estimation. It represents an aggressive schedule in that both shutdown and D&D&D activities are based on double shift operations. This reflects BBWI and DOE-ID desires to complete all fieldwork for the project as early as possible.

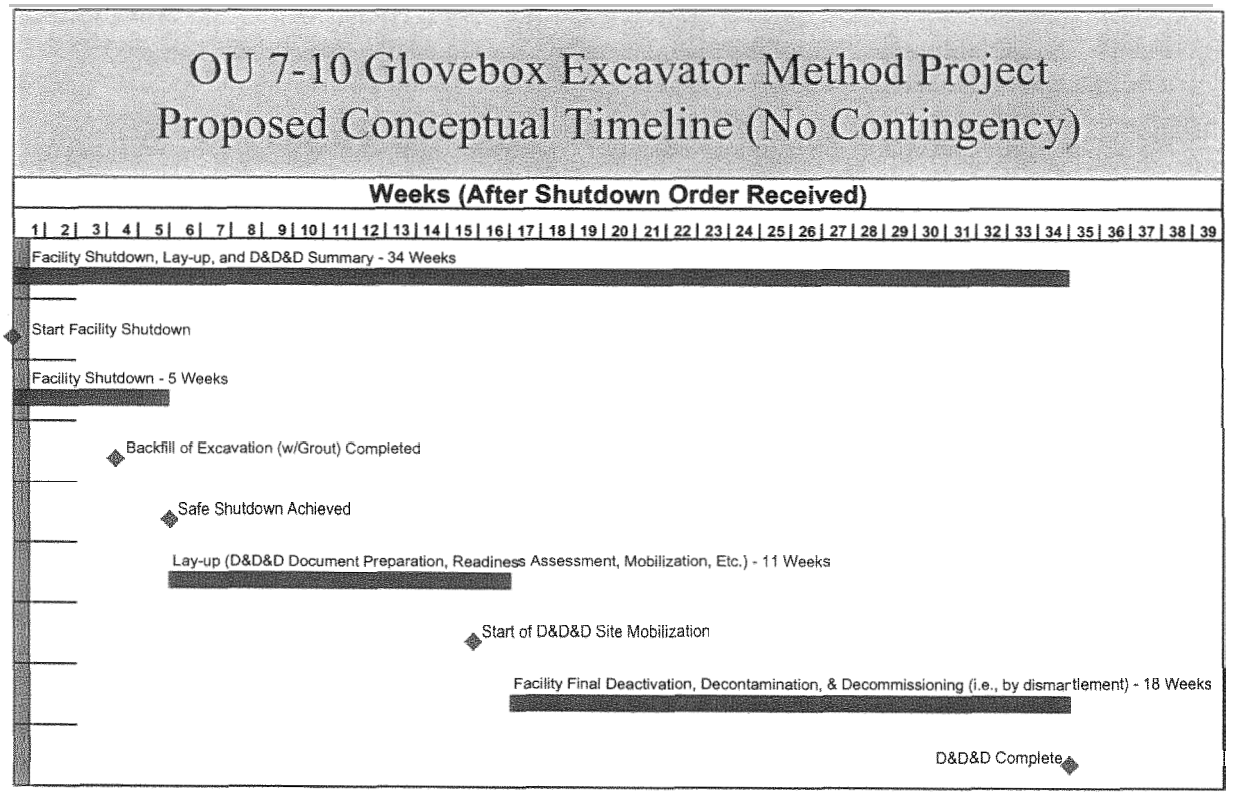

Figure 9. Timeline for performing the OU 7-10 Glovebox Excavation Method Project facility shutdown and deactivation, decontamination, and decommissioning activities.

Caveats to this timeline are listed below:

- The scope of activities is based on the final design and not on an actual facility.
- The facility contamination levels and the capabilities of the DSS are currently estimated, and not known. Also unknown is the behavior of the contaminants in the waste to be excavated. Durations are based on the areas within confinement having a median contamination level (i.e., approximately 1×10^6 dpm per 100 cm^2) relative to the full range of reasonable values

(between 1×10^4 dpm per 100 cm^2 and 1×10^7 dpm per 100 cm^2) and also on contamination having a limited mobility (i.e., contamination spread is minimal where [1] no activities are conducted that may disturb the exposed waste materials and [2] more than air circulation alone is required to spread the contamination). Actual conditions present when retrieval and sampling operations are complete may be significantly better or worse than those used as a basis for this timeline. Therefore, the actual duration for the above phases may be significantly less or greater than that shown. Furthermore, significantly different contamination states may cause the selected shutdown and D&D&D approaches to change altogether (e.g., fully remote operations may be required in the presence of extremely high contamination such as 1×10^7 dpm per 100 cm^2).

- Activity durations developed for this timeline contain no contingency for rework, unexpected conditions, or other delays.

- No holidays are included in the resource calendars, and work shifts and schedules are as stated in the assumptions contained in Section 2.1.

7. PROJECT ASSESSMENTS

This section identifies OU 7-10 Glovebox Excavator Method Project assessments that could impact the processes, equipment, and ending conditions selected for facility shutdown, layup, and D&D&D phases. This section also provides summaries of results, recommendations, and requirements, if applicable, that are contained in these assessments.

7.1 Safety Classification and Category

7.1.1 Hazard Analysis and Classification

A final documented safety analysis document is being prepared to update the *Preliminary Documented Safety Analysis for the OU 7-10 Glovebox Excavator Method Project* (INEEL 2002d). This final documented safety analysis will include discussion on the post-retrieval life-cycle phases and may allow a change in the facility hazard classification based on changing hazard conditions. Table 13 summarizes the results of a preliminary evaluation to forecast facility hazard classifications across the project life-cycle phases based on assumptions documented in Section 2.1. Table 14 predicts the operating status of major structures, systems, and components (SSCs) based on these same assumptions.

Table 13. Safety analysis evolutions during the project facility life-cycle phases.

Project Phase / Hazard Category	Over-burden Removal	Waste Zone Material Processing	Under-burden Sampling	Initial Decontami-nation (prepare for pit grouting)	Pit Grouting	Layup	Deactivation, Decontamination, and Dismantlement		
							New Over-burden	Final Decon-tamination	Dismantle-ment
Hazard Category 2—Documented Safety Analysis (DSA)	E	E	E	E	E	E	E	E	E
Hazard Category 3—DSA	NE	NE	NE	NE	NE	P	P	P	NE
Radiological Low—Auditable Safety Analysis	NE	NE	NE	NE	NE	NE	NE	NE	P
Other Industrial—No additional safety analysis required	NE	NE	NE	NE	NE	NE	NE	NE	P
Legend:	Expected (E)				Possible (P)				Not expected (NE)

As shown in Table 13, several potential safety analysis evolutions could occur during the various life-cycle phases of the project facility. These include (1) documented safety analyses (DSAs) (used for both Category 2 and 3 nuclear facilities), (2) an auditable safety analysis (used for low hazard radiological facilities), and (3) no additional safety analysis required (used for ordinary industrial facilities). The level of required safety analysis can be reduced as the potentially releasable radiological and hazardous

inventories are reduced or when criticality is no longer possible. If the project is classified as low radiological, the DSA, technical safety requirement (TSR), and unreviewed safety question requirements of 10 CFR 830, Subpart B, "Safety Basis Requirements," are no longer applicable. However, the project still will be subject to Price Anderson Amendment Act requirements for nuclear facilities. Because of the short D&D&D period, the facility will likely remain Hazard Category II throughout the D&D&D phase.

Table 14. Forecasted operating status of major project structures, systems, and components by facility life-cycle phase.

Project Phase / Structures, Systems, and Components	Over-burden Removal	Waste Zone Material Processing	Under-burden Sampling	Initial Decon-tamination (preparation for pit grouting)	Pit Grouting	Layup	Deactivation, Decontamination, and Dismantlement		
							New Over-burden	Final Decon-tamination	Dismantle-ment
WES	R	R	R	R	R	R	R	R	NR
RCS	R	R	R	R	R	R	R	R	NR
PGS	R	R	R	R	R	R	R	R	NR
Excavator	R	R	R	R	R	R	R	R	MBR
WES, RCS, and PGS ventilation	R	R	R	R	R	R	R	R	MBR
Drum-out ventilation	MBR	R	MBR	MBR	NR	NR	NR	MBR	NR
Dust suppression	R	R	R	R	R	MBR	MBR	NR	NR
RCS deluge	NR	R	R	R	R	NR	NR	NR	NR
RCS dry-pipe	R	R	R	R	R	MBR	NR	NR	NR
RCS carbon monoxide monitor	NR	R	R	R	R	NR	NR	NR	NR
PGS fire protection system	NR	R	MBR	MBR	NR	NR	NR	MBR	NR
WES dry-pipe	R	R	R	R	R	R	R	R	NR
WES fire alarm system	R	R	R	R	R	R	R	R	NR
Constant air monitors and remote air monitors	R	R	R	R	R	R	R	R	MBR
Criticality alarm system	NR	R	NR	NR	NR	NR	NR	NR	NR

Table 14. (continued).

Project Phase / Structures, Systems, and Components	Over-burden Removal	Waste Zone Material Processing	Under-burden Sampling	Initial Decon-tamination (preparation for pit grouting)	Pit Grouting	Layup	Deactivation, Decontamination, and Dismantlement		
							New Over-burden	Final Decon-tamination	Dismantle-ment
Stack monitoring	NR	R	R	R	R	R	R	R	NR
Primary electrical	R	R	R	R	R	R	R	R	NR
Standby electrical	NR	R	R	R	R	R	R	R	NR
Breathing air	NR	R	R	R	R	NR	R	R	NR
Legend:	Required (R)			May be required (MBR)					Not required (NR)

7.1.1.1 Confinement Systems. The WES, RCS, and PGS will be needed up to the D&D&D phase. Because of the construction sequence and design, if the RCS is required, the excavator, the WES, and the PGS must be in place as well. Therefore, for an activity like overburden removal, all three structures will be in place even though all three may not be required for safety reasons. The RCS and PGS ventilation system may be needed during dismantlement. The drumout ventilation system may be needed during overburden removal if overburden is used during cold runs through the gloveboxes for operator training and qualification. The drumout ventilation system may be needed during underburden sampling if the samples are to be passed through the PGS and then the drumout ports. The drumout ventilation system also may be needed during the initial and possibly the final facility decontamination if the drumout area has been contaminated, or if decontamination materials are to be passed through the PGS for packaging in the drum loadout enclosure.

7.1.1.2 Excavator. The excavator will likely be needed during all operations involving retrieval and grouting operations. Although it will not likely be needed for layup, it may be needed for new overburden placement, decontamination activities, and possibly for dismantlement.

7.1.1.3 Dust Suppression System. The DSS will be needed during overburden removal, waste zone material processing, underburden sampling, and for pit grouting. It likely will not be needed during the other life-cycle activities because the pit will have been grouted or the life-cycle activity will not involve activities in the pit (e.g., layup). A need for dust suppression may exist during the installation of new overburden depending on the delivery method (e.g., sacks vs. soil grout).

7.1.1.4 Fire Protection Systems. To ensure that the risk of potential facility losses are acceptable, the WES dry pipe and fire alarm systems are required for all life cycles up to dismantlement. The RCS deluge and CO monitoring systems are for subsurface fires only. Therefore, these systems are required only as long as the retrieval pit is open. They are not needed after pit grouting. The RCS dry-pipe system will be required through pit grouting and may be required during the layup period. The PGS fire protection system will be required whenever waste or sample-handling operations are being performed in

the gloveboxes. Therefore, the PGS system will be required for waste zone material processing and underburden sampling if the samples are processed through the PGS, or if drums of decontamination waste are passed through the PGS for overpacking.

7.1.1.5 Radiological Instruments. To ensure notifications of potential release or exposure incidents, CAMs and RAMs would be required as long as the potential for a radiological hazard exists in the facility. Therefore, they may be required up through dismantlement. Criticality scenarios are possible only as long as waste is being packaged; therefore, the criticality alarm system is needed only during the waste zone material processing cycle. To ensure potential releases are monitored, stack monitoring would likely be required after the overburden has been removed and for all other facility life cycles through the final decontamination phase.

7.1.1.6 Electrical. Primary and standby electrical power would be needed as long as the ventilation and CAM and RAM systems are needed. Therefore, they are needed up to the dismantlement phase.

7.1.1.7 Breathing Air. The breathing air system would likely be required after the overburden is removed for any personnel entries into the RCS before final decontamination. Workers likely will be in filtered respirators during overburden removal and entries into the RCS will not be needed during the layup period. Worker entries will be required during initial decontamination, pit grouting, new overburden placement and final decontamination.

7.1.2 Safety Category

The safety category of SSCs may change after reaching the post-retrieval life-cycle phases discussed in this plan based on updates to or supercession of the DSA. Changes in safety category for the various project SSCs have not been forecasted at this time. However, such changes could affect detailed plans for maintenance actions (e.g., repairs) during the layup period.

7.2 Health and Safety

The project is preparing a HASP with more details on implementation of INEEL *Manual 14A - Safety and Health – Occupational Safety and Fire Protection* and *Manual 14B - Safety and Health Occupational Medical and Industrial Hygiene*. This HASP will cover operations up through the D&D&D phase of the project, including waste retrieval operations, underburden sampling, shutdown operations, and facility layup. A separate HASP will be prepared for D&D&D operations and will be discussed in the final D&D&D Plan. Both HASPs will cover appropriate safety measures based on assessed hazards including industrial, radiological, and fire safety hazards. This plan has been prepared with input from project radiological and industrial safety personnel.

7.3 Safeguards and Security

Videotape footage of the retrieval and packaging operations will be taken to identify classified materials and items in case they are encountered during the retrieval demonstration. Before the initiation of shutdown operations, appropriate security personnel must review the videotapes and verify that no potentially classified materials and items were packaged into the waste drums. The duration of this review is expected to be less than 1 week at which time all drums should be dispositioned based on the review

findings. Delays in completing the necessary reviews may delay the start of shutdown operations. The review of tapes will be performed by the Classified and Sensitive Unclassified Information Office using PLN-632, "Operable Unit 7-10 Staged Interim Action Project Physical Security Plan." A contingency plan will soon be written to address classified or sensitive items in case they are encountered.

Normal RWMC access and security requirements will apply during post-retrieval project phases. No other safeguards and security impacts are anticipated for these phases of the project.

7.4 Emergency Preparedness

Emergency preparedness activities for all project operations will be covered in the Addendum 3 of PLN-114, "INEEL Emergency Plan/RCRA Contingency Plan." This plan is updated annually to include new operations. This Facility Shutdown Plan and D&D&D Pre-Plan document and the final D&D&D Plan will be used to update PLN-114.

7.5 Risk Management

Table 15 identifies risk items from the Project Risk Management Plan (PLN-1024) that have the potential to impact assumptions, conditions, plans, or estimates contained in this plan. Monitoring of risk response plan activities for these risk items throughout their execution may provide early indications of impacts to this plan. Because of the anticipated short interval between start of waste retrieval and start of shutdown, early detection of impacts to this plan is especially important to increase the time available for impact recovery and resolution.

Table 15. Risk items that may impact facility life-cycle phases.

Risk Tracking Number[a]	Risk[b]	Managed Action Level	Comments
O23	Loss of ventilation flow occurs, increasing the risk of contamination release into the WES.	**High**[c]	e
O25	Noncatastrophic glovebox glove leak or failure occurs.	**High**[c]	f
O26	Catastrophic leaking or glovebox failure occurs.	**High**[c]	f
O2	Fire occurs in confinement area involving waste materials.	**High**[c]	e
S/R1	Excavator operation causes fire and personnel exposure.	**High**[c]	f
O35	Operator punctures glove by using tool or handling cart improperly causing breach of confinement.	Moderate	f
O34	Operator pulls off or cuts hole in bag causing breach of confinement.	Moderate	f
O22	Operator bumps transfer cart support with excavator boom, and support breaks away from wall causing breach of confinement.	Moderate	f

Table 15. (continued).

Risk Tracking Number[a]	Risk[b]	Managed Action Level	Comments
O31	Operator drops load from transport equipment causing breach of confinement.	Moderate	f
O33	Operator does not properly connect drum interfaces causing breach of confinement.	Moderate	f
O19	Probe is dropped by excavator and breaches the RCS.	Moderate	f
O28	Contamination is spread into WES from RCS, and additional safety measures affect cost and schedule.	Moderate[d]	e
O30	Operator loses control of transport equipment, causing breach of confinement.	Moderate[d]	f
O32	Operator unintentionally engages boom controls and boom hits RCS.	Moderate[d]	f
O21	Pit is flooded with water from run-on from rainfall or pipe leak. Work is delayed and costs increase.	Low	e

Note: This table is grouped by the managed action levels of the risks: high, moderate, and low (highlighted in orange, yellow, and green, respectively).

a. Categories: D/C = design and construction; E/R = environment and regulatory; O = operations; P/C = procurement and contract; P = programmatic; R = resources; S/R = safety and radiological health

b. The risk analysis worksheets in Appendix C of the "Risk Management Plan for the OU 7-10 Glovebox Excavator Method Project" (PLN-1024) contain complete details and proper context.

c. Moderate-level risk, but high-level risk management action plan will be used.

d. Low-level risk, but moderate-level risk management action plan will be used.

e. A loss of confinement would likely invalidate assumptions about the WES (including enclosed systems), the FFS (excluding the shoring box), and overburden soils having no detectable contamination from project waste retrieval operations.

f. A breach in confinement would likely invalidate assumptions about the WES (including enclosed systems), the FFS (excluding the shoring box), and overburden soils having no detectable contamination from project waste retrieval operations.

7.6 Configuration Management— Changes Since the Conceptual Design Report

This section identifies project baseline changes since the submittal of the OU 7-10 Glovebox Excavator Method Project CDR (INEEL 2002b) that affect assumptions, conditions, plans, and estimates associated with post-retrieval facility life-cycle phases.

7.6.1 Closure Process

The term "closure" was replaced with "shutdown." "Closure" has a regulatory meaning that was not intended.

7.6.2 Underburden Sampling

Sampling of the underburden has been redefined as part of retrieval operations rather than a shutdown activity.

7.6.3 Soil Fixative in Pit

To prevent the need for personnel entry to spray a soil fixative in the open pit, the water spray from the DSS is used to control contamination. This spray will be turned on as needed to control contamination from the open pit.

7.6.4 Overburden Disposal

The operation of returning the overburden soil to the waste zone of the pit after retrieval operations is more complex than was justified. As a result, the cost of returning the overburden to the pit is significantly higher than backfilling the waste zone with a clean loose (i.e., weak) grout mixture. The analysis and decision to backfill the pit with loose grout and alternative for the final disposition of the overburden soil is documented in "Evaluation of Overburden Soil Characterization Information and Disposal Options for the Glovebox Excavator Method Project (Operable Unit 7-10) (Draft)."[g]

7.6.5 Overburden Trench Box (Shoring Box)

The shoring box will not be left in place as was stated in the CDR (see footnote f). This change is to satisfy RWMC and Radiological Control requirements for maintaining a clean protective soil cover over the waste having a minimum depth of 1 m (3 ft). The shoring box will instead be removed during the D&D&D phase of the project.

7.6.6 Disposition of Transuranic and Orphan Waste

Retrieved waste and secondary and D&D&D TRU waste, as well as waste that contains greater than 10 nCi/g TRU material, will be stored onsite instead of being sent to the AMWTP for disposition. Disposition of these waste streams will be evaluated as part of Stage III.

7.7 Quality Assurance

No quality assurance impacts to this plan are anticipated. However, quality assurance will need to be addressed relative to sampling and analysis for initial facility and waste characterizations and for verification that end-state criteria (see definition) have been met. Specific end-state criteria for this project will be developed and documented in the final D&D&D plan.

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g. Burton, Brent N., 2002, "Evaluation of Overburden Soil Characterization Information and Disposal Options for the Glovebox Excavator Method Project (Operable Unit 7-10) (Draft)," EDF-2161, Rev. A., INEEL, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho.

7.8 Environmental

This section identifies environmental assessments that define or impact assumptions, expected conditions, actual conditions, plans, or estimates associated with post-retrieval facility life-cycle phases.

7.8.1 Project Waste Management Plan

The Waste Management Plan (INEEL 2002c) is the governing document on all waste generated by the OU 7-10 Glovebox Excavator Method Project. The Waste Management Plan and this plan were prepared jointly and information has been shared and coordinated. During preparation of the final D&D&D plan, when additional information will be available, the waste generation tables in the Waste Management Plan will require updating.

7.8.2 Air Emissions Evaluations

Currently, the air emissions evaluations address only the retrieval phase of the project (Abbott 2002). Information provided in this plan may be used to update the air emissions evaluation to include the facility shutdown, layup and D&D&D phases of the project. Also, results of this update may impact the identified SSCs required to be operational during these phases (e.g., stack monitoring system).

7.8.3 Applicable or Relevant and Appropriate Requirements

Regulatory requirements have been identified in this document as reviewed by project environmental personnel. However, this plan does not include a complete regulatory analysis for implementing these requirements. An engineering design file (EDF) is being prepared by project environmental personnel to more completely address the impact of ARARs on this project.

8. REFERENCES

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40 CFR 261, 2002, Title 40, "Protection of Environment," Part 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, Office of the Federal Register.

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APPENDIX A

OU 7-10 Glovebox Excavator Method Project Design Impacts from Deactivation, Decontamination, and Decommissioning Issues

A.1 INTRODUCTION

This appendix lists the impacts from deactivation, decontamination, and decommissioning (D&D&D) issues on the design of the Operable Unit (OU) 7-10 (Pit 9) Glovebox Excavator Method Project facility and equipment at the Radioactive Waste Management Complex of the Idaho National Engineering and Environmental Laboratory (INEEL).

The facility and equipment design engineers considered D&D&D issues as part of the design for life-cycle costs. To assist in life-cycle design, engineers working on the plans for the facility shutdown and D&D&D phases met with the designers to discuss additional improvements to the designs that would facilitate the work to be performed when the facility has completed its mission and will no longer be needed. The design engineers made the decisions on which suggestions to implement in accordance with overall design needs.

The majority of necessary design features for D&D&D issues were already included in the designs by the engineers. These features are listed first and features added as a result of suggestions by D&D&D personnel are discussed last.

Design impacts from D&D&D are discussed for the following facilities and equipment:

- Retrieval Confinement Structure (RCS)
- Weather Enclosure Structure (WES)
- Shoring box
- Packaging Glovebox System (PGS)
- Heating and ventilation (H&V) system
- Excavator
- Piping systems
- Electrical systems

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A.2 DESIGN FEATURES FOR THE DEACTIVATION, DECONTAMINATION, AND DECOMMISSIONING PHASE INCLUDED IN THE ORIGINAL DESIGN

A.2.1 Retrieval Confinement Structure

Features of the RCS that were designed to facilitate D&D&D at the end of the OU 7-10 Glovebox Excavator Method Project are listed below:

- The RCS is of a modular design, which is more easily disassembled than standard frame and skin designs.
- The frame is on the outside of the skin, which makes decontamination easier than if the frame were on the inside.
- The skin is flat, smooth, stainless steel, which is easily decontaminated.
- The seams of the RCS are taped to cover and protect cracks and joints that would hold contamination and be hard to clean. The joint tape can easily be cut or stripped during disassembly.
- No extraneous materials or equipment were placed within the RCS. Minimizing materials and equipment in the RCS confinement area will reduce the time, scope, and cost of D&D&D activities.

A.2.2 Weather Enclosure Structure

Features of the WES that were included in the design to facilitate D&D&D at the end of the project are listed below:

- The WES is a fabric structure, which is more easily disassembled than a standard frame and metal skin design.
- The fabric structure is reusable, which is expected to reduce the amount of D&D&D waste from the project.
- If the WES is accidentally contaminated or becomes unsuitable for reuse, the fabric is more easily disassembled and disposed of than a standard frame and metal skin building. The fabric can be cut into pieces and either added to other disposal boxes as extra fill or rolled into bundles for direct disposal.
- No extraneous materials or equipment were placed within the WES. Minimizing materials in the WES reduces the time, scope, and cost of D&D&D activities and reduces the amount of material and equipment that is at risk of becoming contaminated should a breach or loss of confinement occur.

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A.2.3 Shoring Box

Pinned joints in the shoring box were included in the design to facilitate disassembly during removal of the shoring box during the D&D&D phase. When the decision was made to seal-weld the joints, the advantages of the pinned joints no longer justified the cost (because cutting the shoring box at the joints would now be required anyway), and the design was changed to eliminate the pins.

A.2.4 Packaging Glovebox System

Features of the PGS that were included in the design to facilitate D&D&D following the end of the project are listed below:

- The glovebox frames are made of carbon steel. Although less easily decontaminated than stainless steel, carbon steel can be decontaminated to levels that achieve project goals. Because carbon steel is less expensive than stainless steel, it reduces overall project costs.

- The inside corners of the gloveboxes are rounded, providing to facilitate decontamination. Because the cost of rounded corners in a glovebox is approximately the same as square corners, this design feature reduces overall costs.

- The glovebox frame at the opening to the RCS is internal (i.e., smaller than) to the RCS frame. This configuration would allow the glovebox to be slid inside the RCS for decommissioning once the RCS skin above the opening has been removed. While this is not the selected approach, it does allow an alternate approach for D&D&D flexibility. For example, this approach may become necessary in the event that radioactive contamination levels in the gloveboxes are significantly higher than expected.

- The support structures below the gloveboxes are bolted to the glovebox frames. This allows the glovebox frames to easily be unbolted from the supports, then the glovebox either may be slid into the RCS or laid over on the floor next to the supports.

- The transfer cart conveyance system uses a dry screw. This feature eliminates grease on the screw, which would be difficult to decontaminate and could result the creation of mixed transuranic (MTRU) waste.

- A method of containing any contamination spread that may occur from drumout operations is included in the PGS design. Initially, the design included a ventilation trunk near the drumout ports. The design has since been changed to add a full enclosure around each drumout operation that is connected to the high-efficiency particulate air (HEPA) filtered H&V system. These enclosures form a buffer zone between the highly contaminated glovebox interiors and the clean WES.

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A.2.5 Heating and Ventilation System

Features of the heating and ventilation system that were included in the design to facilitate D&D&D at the end of the project are listed below:

- Radiological survey ports are located upstream and downstream of the primary exhaust HEPA filter bank. These ports will allow the radiological contamination levels in the ducting to be determined before dismantlement, which will improve the safety of the operation and decrease the cost.

- The length of the air ducts has been minimized. The air ducts are round and will be made of stainless steel, which is easier to decontaminate than rectangular ducts made of galvanized carbon steel. Flexible ducting, which tends to difficult to decontaminate has not been used.

- The H&V fans are variable speed. This design allows the air flow to be decreased during shutdown and layup, reducing wear and electricity consumption. Variable-speed fans also will support fixative fogging should this activity become necessary.

- The H&V fans are located downstream of the HEPA filters, reducing the expected contamination levels and providing a potential for reuse.

- The H&V system is designed to operate year round. This design allows shutdown and dismantlement activities to take place in heat and cold, and provides the necessary operating environment for radiological detectors needed during all phases.

A.2.6 Excavator

Features relative to the excavator that will facilitate D&D&D at the end of the project are listed below:

- Lines to the power steering and brake control systems will be capped off once the excavator is installed to eliminate potential contamination of these systems through the hydraulic fluid. The supply and return hydraulic lines will be capped to the power steering control valve. The brake pump, suction line, and return line will be disconnected and capped.

- The outriggers and cylinders will be removed and the hydraulic lines capped off at the control valve to reduce the equipment that may become contaminated.

- The front-end loader control valve and hydraulics will be disconnected and capped once the excavator is installed to reduce the equipment that may become contaminated. The loader hydraulic cylinders will be removed for mounting purposes.

- The excavator will be fitted with a self-greasing system, which will prevent the need to grease the fittings after any layup period and before use during D&D&D.

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- The hydraulic fluid will be a nonhazardous, environmentally safe fluid recommended by the equipment manufacturer. Disposal of this fluid will be easier than for standard petroleum-based hydraulic fluids.

- An in-line hydraulic fluid sampling system will be installed. This will facilitate fluid sampling during D&D&D operations. The sampling location is immediately upstream from the filter.

- The hydraulic fluid filter has been moved to a more accessible location. The new location allows (or permits) easier access for changing the potentially radioactively contaminated filter and for monitoring the filter for radiation levels.

- A large drip pan will be used under the excavator. Extra drip pans will be located under the hydraulic fluid and fuel tanks.

- A drain is located in the bottom of the inner seal area where the excavator arm interfaces with the RCS. When decontaminating this hard-to-reach area, the drain will provide a method of removing from the area any water that may be used in decontamination. This drain was already planned for draining any hydraulic fluid leaks, but also will assist decontamination efforts if water accumulates in the seal area.

A.2.7 Dust-Suppression System

Features relative to the dust-suppression system (DSS) that will facilitate D&D&D at the end of the project are listed below:

- Check valves and isolation valves just outside the confinement wall of all piping systems are included in the design to prevent backflow during operations and after the systems are drained during facility shutdown or D&D&D. These valves were added to some of the piping systems at the suggestion of the shutdown and D&D&D engineers, and some of the systems already included these valves in the design.

- The DSS is the primary method of contamination control in the facility. The use of this system is expected to greatly reduce the scope of the decontamination and dismantlement activities of the RCS, PGS, and associated equipment.

- The DSS, as designed, will support the facility shutdown process by reducing contamination spread from the pit after retrieval operations have been completed. The DSS is remotely controlled, which provides operators flexibility during the shutdown process to use the system from a different location than during operations.

- The DSS controls and tanks are located outside the primary confinement to prevent contamination of DSS equipment.

- The DSS uses flexible hose, which is more easily dismantled than hard piping.

- The DSS is a skid-mounted, reusable piece of equipment. Modular design allows for easy removal from the facility.

- All piping is routed outside of primary confinement boundaries whenever feasible. This will reduce the amount of contaminated materials that will be generated during D&D&D. Penetrations will be made for each branch, instead of making one penetration and running the distribution piping inside the confinement boundary.

- The amount of piping has been minimized.

A.2.8 Compressed Air Systems

- The plant air and breathing air compressors are located off the pit area, reducing the radiological survey requirements for release of the systems. The compressors are modular (i.e., skid mounted) and easily removed by a forklift during D&D&D.

- All piping is routed outside of primary confinement boundaries whenever feasible. This will reduce the amount of contaminated materials that will be generated during D&D&D. Penetrations will be made for each branch, instead of making one penetration and running the distribution piping inside the confinement boundary.

- The amount of piping has been minimized.

- The plant air and breathing air compressors are reusable equipment, which reduces the amount of waste produced by project activities.

A.2.9 Electrical Systems

- Lights are located outside the primary confinement boundary of the PGS and RCS. This eliminates the need to decontaminate or dispose of the materials as MTRU waste.

- Electrical wiring and equipment are located outside the primary confinement boundary of the PGS and RCS wherever possible. This reduces the amount of material requiring decontamination or disposal as MTRU waste.

- Equipment inside the WES has been minimized, which minimizes the amount of equipment that could potentially become contaminated if primary confinement is breached. Locating equipment outside the WES also reduces the radiological survey requirements for equipment reuse.

- Low-mercury fluorescent light bulbs suitable for landfill disposal are used.

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- The electric transformer and main distribution panel are located off the pit. Locating the equipment off the pit provides to facilitate radiological release for equipment reuse.

- The standby diesel generator is located on a trailer in the project work area outside of the pit boundary, which is away from areas of potential contamination. This location is expected to reduce the radiological release requirements and the modular design facilitates removal by towing.

- The excavator will be refueled from the fuel tank located on the diesel generator trailer, which reduces the potential for spills that would require remediation during D&D&D. The generator also is provided with a spill container for fuel and oil.

- The power distribution panel substation is reused from a previous project. This reduces the overall waste from project activities. The substation may be used again for future projects.

- Approximately half of the high-voltage cabling is reused from a previous project, which reduces the overall waste from project activities.

A.3 DESIGN FEATURES ADDED FOR THE DEACTIVATION, DECONTAMINATION, AND DECOMMISSIONING PHASE

A3.1 Retrieval Confinement Structure

A thin, stainless steel plate will cover the floor of the RCS. This plate is designed to prevent contamination from reaching the Facility Floor Structure in the RCS. The amount of MTRU waste requiring decontamination and disposal as LLW is reduced from the entire floor structure to a thin plate.

A3.2 Weather Enclosure Structure

Nothing identified.

A3.3 Shoring Box

The shoring box assembly will include a geotextile fabric (secondary) skirt under the stainless steel skirt. This change was developed to mitigate problems associated with contamination reaching the back of the shoring box if the soil beneath the box is undercut during excavation. The flexible geotextile fabric is expected to more easily extend downward with the sloughing soil than the rigid metal skirt. This adherence to the moving soil would fill any holes created below the floor better than a rigid sheet of metal.

A3.4 Packaging Glovebox System

Nothing identified.

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A3.5 Heating and Ventilation System

The facility air emissions stack will be designed to facilitate radiological surveillance and disposal in approved waste boxes. The stack is expected to be radiologically clean and disposable as industrial waste, but must either be surveyed to ensure cleanliness or treated as contaminated. Breaks in the pipe length with flanges allow for the pieces to be disassembled without cutting and facilitate surveys for disposition. The design will evaluate the cost of flanges and welded joints to determine the number and location of flanged joints and welded joints, if any.

A3.6 Excavator

- A HEPA filter will be added to the hydraulic fluid tank to address venting from the tank when hydraulic fluid temperature increases.

- The unused hydraulic lines will be capped in the most accessible locations. This criterion takes precedence over reducing the amount of potentially contaminated lines by capping as close to the tee as possible.

- Epoxy paint will be used on any areas of the excavator that require repainting as part of design modification, especially the inner seal. Any potential savings in D&D&D operations do not justify the cost of repainting other parts of the excavator with epoxy paint.

- The capability for a small shear will be added to the excavator, if feasible. The ability to connect a shear to the excavator will provide significant cost savings to D&D&D. Using a shear from outside the RCS is also a much safer method of dismantling than manual methods performed inside the RCS.

- A range of available hydraulic cylinder seal types will be considered to determine if a better seal is available that could reduce or potentially eliminate the contamination from reaching the inside of the hydraulic system. Although experience from the D&D&D organization has shown no detectable contamination of hydraulic systems in D&D&D equipment, the potentially very high levels of plutonium inside the RCS and the close proximity of hydraulic cylinders to the waste warrant preparation for contamination of the excavator hydraulic system. According to the engineer from Caterpillar contracted to assist in design of this excavator more effective seals are available. It is possible that the hydraulic system could be kept clean from contamination, or contamination levels kept to a minimum If accomplished, this is expected to be a considerable cost savings and waste reduction to the project. In previous work, the Caterpillar excavator engineer found that Viton seals were excellent for chemical and radiological resistance.

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A3.7 Dust-Suppression System

A drain and sample valve will be added to the DSS water tank. This will provide an easy method to sample the water in the tank to ensure that it is not radiologically contaminated. The drain also will simplify pumping the water into a tanker truck for disposal.

A3.8 Compressed Air Systems

Nothing identified.

A3.9 Electrical Systems

Nothing identified.

A.4 DESIGN FEATURES DISCUSSED BUT NOT ADDED FOR THE DEACTIVATION, DECONTAMINATION, AND DECOMMISSIONING PHASE

Many suggestions were made that would have reduced the costs of D&D&D that were not implemented by design because of the overall project costs or other important factors. Most of these suggestions are not discussed in this appendix. Noteworthy suggestions are discussed below.

A4.1 Retrieval Confinement Structure

Nothing identified.

A4.2 Weather Enclosure Structure

Nothing identified.

A4.3 Shoring Box

Making the shoring box skirt from a geotextile fabric (attached at the base of the shoring box), instead of a steel sheet (attached on the back side of the shoring box at ground level) would likely resolve the problem of contamination on the back of the shoring box if the box is undercut during excavation. The flexible geotextile fabric would fill holes below the floor better than a rigid sheet of metal as the skirt is currently designed. And if the fabric was attached to the base of the shoring box, it would always be between the shoring box and the exposed waste.

A4.4 Packaging Glovebox System

Nothing identified.

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A4.5 Heating and Ventilation System

Nothing identified.

A4.6 Excavator

- The possibility of booting any of the cylinders to reduce potential contamination paths was discussed. The design team had already looked at this and was unable to use any boots because of the lack of room and the restriction boots would put on cylinder stroke.
- Any potential savings in D&D&D operations do not justify the cost of repainting most parts of the excavator with epoxy paint.

A4.7 Dust-Suppression System

Nothing identified.

A4.8 Compressed Air Systems

Nothing identified.

A4.9 Electrical Systems

Nothing identified.